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FIELD CROP YIELDS IN NEW JERSEY FROM 1876 TO 1919

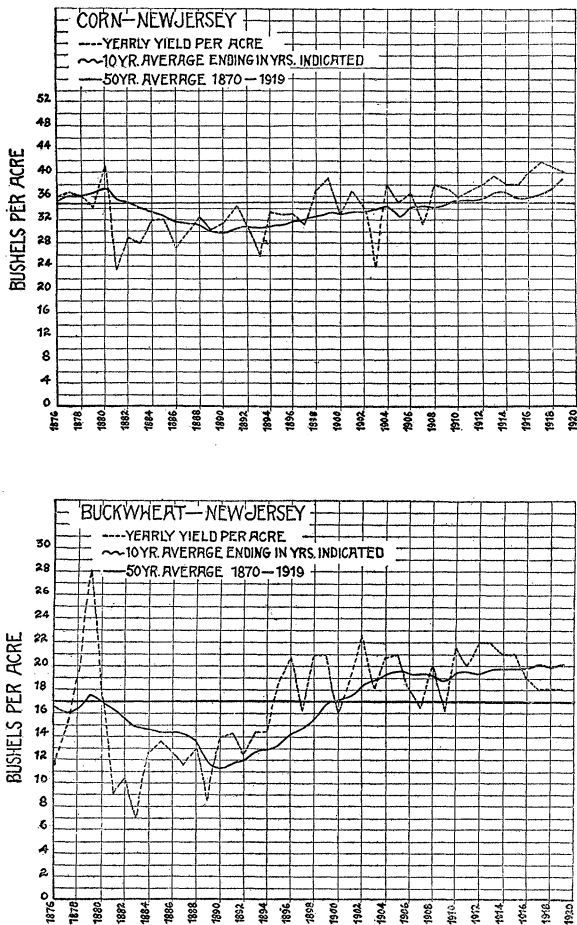
By HARRY B. WEISS

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WHILE New Jersey, on account of its extensive trucking areas, its peach and apple orchards, its plantations of small fruits, etc., is generally known as the "Garden State," as a matter of fact about 75 per cent. of its agricultural acreage is devoted to the growing of corn, wheat, rye, oats, buckwheat, potatoes, sweet potatoes and hay. In spite of its varied and intensive manufacturing interests and its growing suburban territory, its farms produced in 1920 over 11,000,000 bushels of corn, 1,500,000 bushels of wheat, over 1,000,000 bushels of rye, almost 3,000,000 bushels of oats, 2,000,000 bushels of sweet potatoes, almost 15,000,000 bushels of white potatoes and 545,000 tons of hay. It is entirely with these crops that the present paper deals, particularly with their average yields per acre from 1876 to 1919. A study of the yields over such a length of time should indicate at least in part either agricultural progression or retrogression and should afford some evidence as to the value and results of agricultural teachings over that period.

Of the factors controlling yields, climate undoubtedly is the most important and by climate is meant sunlight, the presence or absence of which influences the amounts of sugars, starches, fats, proteins, etc.; temperature, which influences germination, growth and in part the activities of soil bacteria and moisture or rainfall which determines the activities of soil bacteria and hence the availability of plant food. Only occasionally are all of the elements making up climate favorable for the plant over its entire period of growth and when this happens we have as a rule maximum yields and bumper crops. Climate as a whole can not be regulated, although by irrigation rainfall can be supplemented. By the selection of hardy species of plants some climatic effects can be overcome and by mulches, evaporation and therefore loss of heat from the soil can be reduced. For the most part however yields are at the mercy of climate.

Another important factor entering into yields and one which is controllable to a certain point is the fertility of the soil. The natural fertility can be added to by the use of commercial fertilizers and farm



and green manures. The soil itself can be improved by the use of green and animal manures for the purpose of increasing the amount of vegetable matter and therefore its water holding power and bacterial activities. Increasing the yielding power by the addition of fertilizers is of course possible only up to the point where the law of diminishing returns starts to operate and other limiting factors are extra labor and material costs which must be considered together with the prices received for farm products.

Still another element is crop rotation. A good rotation favors high yields by utilizing plant food more evenly, by conserving moisture and regulating humus and by the prevention of rapid losses of fertility. In other words, one crop helps to prepare the soil for another or for the following one. Additional elements influencing yields are seed selection, preparation of seed bed, winterkilling, wind injury and the activities and control of injurious insects and plant diseases.

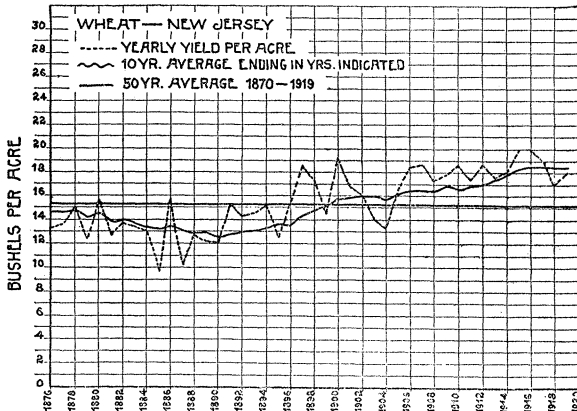
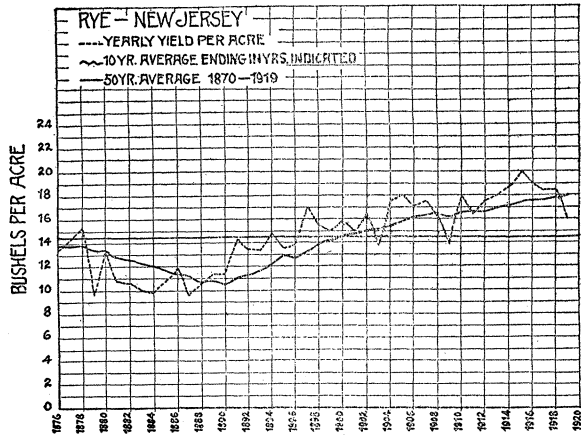
Having thus briefly and generally covered the more important factors bearing upon yields, let us turn our attention to the charts showing the curves of yearly average yields per acre, together with ten-year averages and the fifty-year average for the important field crops of New Jersey. The ten-year average curves are based on the yearly averages, this resulting in lines which are much easier to follow. It is with such curves that we will deal principally. As shown in the chart, the average yield of corn began to decline below the fifty-year average about 1883 and continued until 1890 when the lowest point was reached. From 1891 it rose slowly but not until 1909 or 18 years later did it reach the fifty-year average again. From 1891 however the ten-year average slowly increased. Buckwheat dropped below the fifty-year average line about 1881 and further declined until 1890 when it reached its lowest point. From then on it increased sharply until 1899, when the fifty-year average was reached and continued less sharply from that date. Rye began to decline in average yields in 1881 and reached a low level in 1890, after which it gradually increased. Wheat followed a course similar to that of rye. The ten-year average curve for oats shows little variation for the entire period. The hay curve shows a slight decrease about 1880 and continues down until 1889. From 1890 on it rises slowly. The potato curve shows little variation until 1902 after which date it climbs steadily. The sweet potato curve indicates a steady increase in average yields from 1878 on with the greatest rate of increase taking place after 1899.

COMPARISON OF TEN-YEAR AVERAGE CURVES

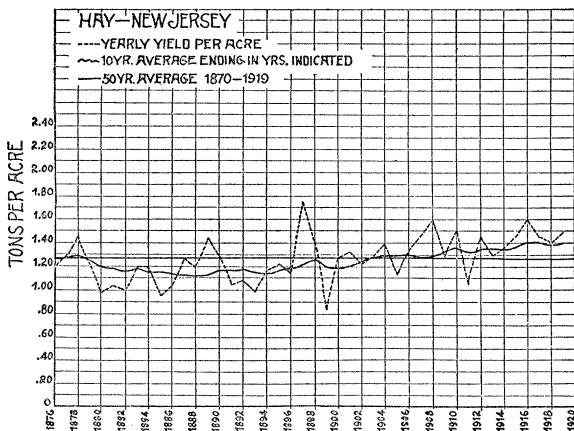
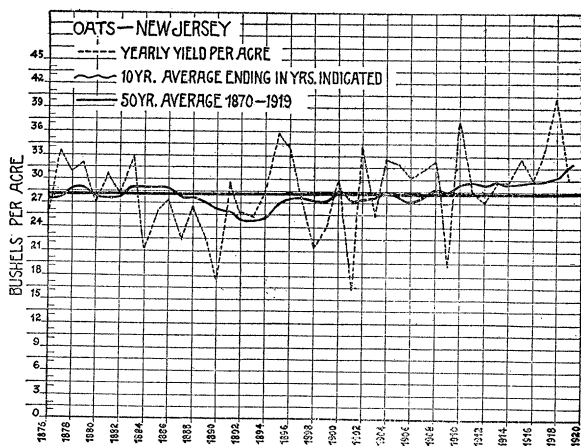
Crop	Decline begins	Lowest point reached	Increase begins
Corn -----	1883	1890	1891
Buckwheat -----	1881	1890	1891
Rye -----	1881	1890	1891
Wheat -----	1881	1890	1891
Hay -----	1880	1889	1890
Potatoes (white) -----			1902
Sweet potatoes -----			1899

From 1880 to 1883 all of the above crops except white and sweet potatoes began to yield less, the lowest points being reached in the years 1889 and 1890. From 1891 on, the average yields of most gradually increased, potatoes, sweet potatoes and buckwheat at a faster rate than corn and hay.

In an attempt to explain the causes underlying the dips and rises in the ten-year average curves, the climatic factor can be ignored. It is difficult to find any single definite reason which will account for the declines in the cases of corn, buckwheat, rye, wheat and hay from 1880 to 1890. It was suggested that a loss of the natural fertility might

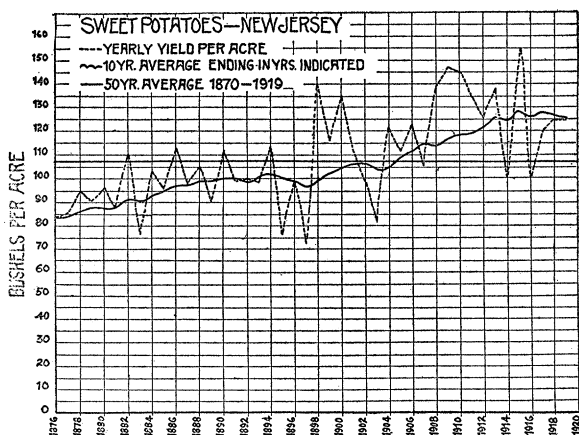
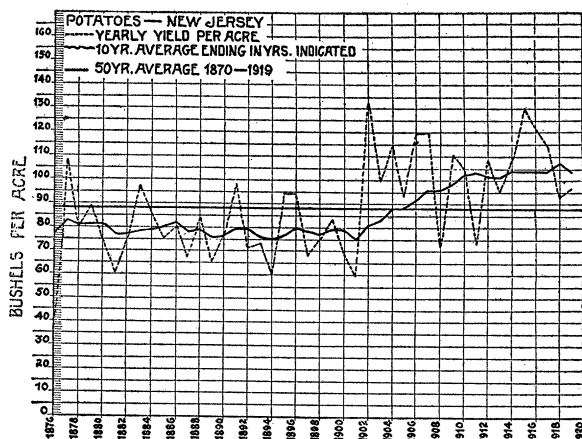


have taken place at that time but this is not possible because the cultivation of the soil in New Jersey was neither intensive nor long continued enough by 1890 to produce such a state of affairs. It was also suggested that this decline was probably due to the fact that the farmers at that time were not getting enough money for their products to warrant the purchase of fertilizers. A study of the prices received by New Jersey farmers for their products from 1866 to 1920 as shown by the chart in which corn, wheat and potato prices are plotted as fair examples, indicates that while prices from 1880 to 1890 were low compared with the prices for previous years, they were on the whole slightly higher than the prices received from 1900 to 1910 during which time more commercial fertilizers were being used and yields were increasing. However between the years 1880 and 1890 the prices of farm products were undoubtedly dropping faster than the prices of manufactured articles and such a condition would lead to retrenchment on the farms. Dr. Jacob G. Lipman, director of the New



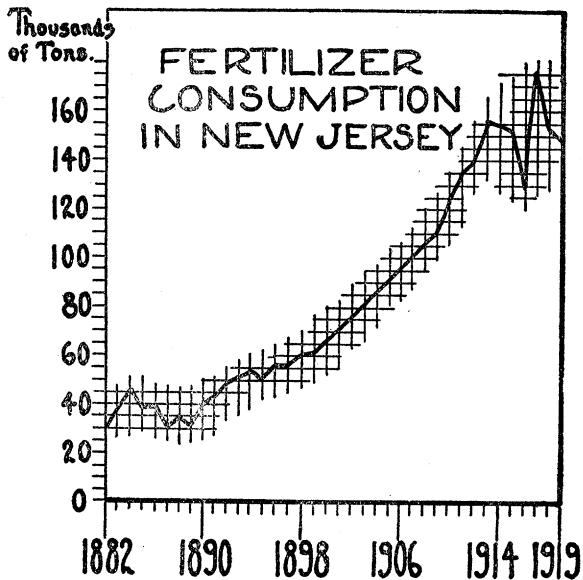
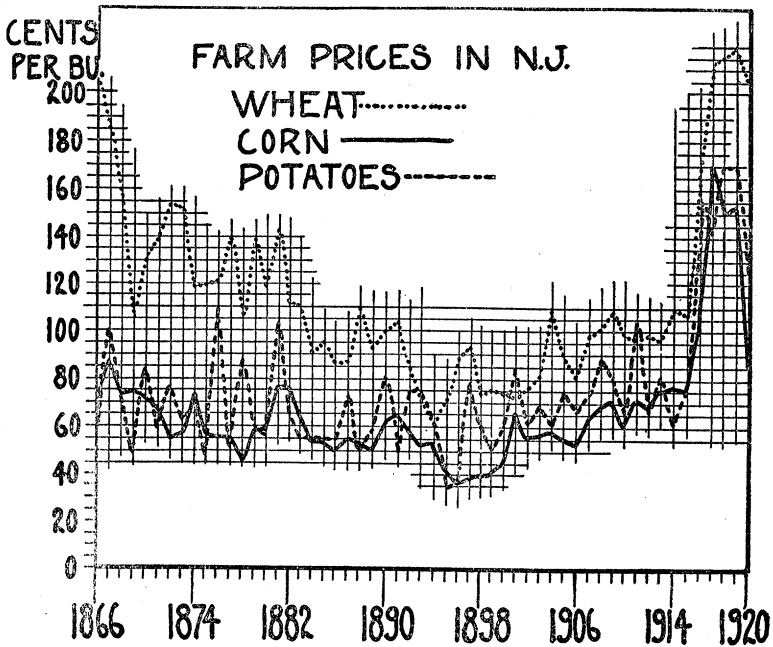
Jersey Agricultural Experiment Stations, informs me that the early '80's marked the end of the extensive use of greensand marl in New Jersey and that commercial fertilizers were just beginning to come in. With the discontinuance of the extensive use of marl after 1875 and the lack of familiarity on the part of the farmers with commercial fertilizers, there was naturally a period of depression in the fertility conditions.

There is the additional fact to consider that in the early years statistics were not gathered as accurately as they were later, and in view of a lack of figures on which to compute ten-year averages before 1876 the declines between 1880 and 1890 may quite possibly be parts of a more or less natural cycle such as one might find when considering such variable items as yields and the factors influencing them over a long period of time. Moreover, for the most part, the declines are



not startling as will be seen by examining the scale of the charts and may represent simply a low level in production.

The rises of the ten-year average curves are of more interest. These show no tendency to follow definite cycles arrangeable into up and down periods, at least not for the thirty-year period from 1891 to the present time. Practically all of them except the one for oats show a more or less gradual increase from 1891 on. In explaining the reason for this, some light may be thrown on the subject by noting the graph showing the rapid growth in the use of commercial fertilizers in New Jersey. The New Jersey Experiment Station was established in 1880 and its work in developing the knowledge of the use of commercial fertilizers is one of the outstanding services that it has rendered. From 1882 to 1890 the nine-year average consumption was about 36,000 tons. From 1890 on, the tonnage gradually increased until at



the present time about 150,000 tons are used each year. At present there is a more or less marked tendency toward the use of more concentrated fertilizers, which means that a smaller tonnage is furnishing the same amount of plant food formerly furnished by a larger tonnage. The curve of fertilizer consumption from 1890 on fits in nicely with the ten-year average crop yield from that date and it is

reasonable to assume that such fertilizers are in part responsible for the increase in average yields. This is especially true for potatoes on which comparatively large applications are made and to a less extent for sweet potatoes. Both are cash crops.

About 75 per cent. of the fertilizer tonnage is used in the southern two-thirds of the state and some of this is used for crops not considered in this paper. It is in this section that the bulk of the white potato and all of the sweet potato crops are grown. North of where most of the commercial fertilizer is used, are found the bulk of the wheat crop, about one-half of the rye and practically all of the oat and buckwheat crops. Corn and hay are generally distributed over the entire agricultural section of the state. The slow rate of increase in hay yields is undoubtedly due to the fact that in the usual rotations practiced in New Jersey, hay follows such crops as corn, potatoes and wheat and does not receive fertilizer applications to the same extent as other crops. Oats not being a cash crop would naturally receive less attention than the others and this accounts for the little variation in the ten-year average curve. In the potato, sweet potato and tomato sections of the state, other crops like corn and grass are the beneficiaries from the use of large amounts of fertilizers. Buckwheat, which is a minor crop, has received little or no attention in the way of improvement. It is a crop which yields well on poor land. According to the chart this crop shows a somewhat higher rate of yield increase than the others. This is due to the fact that it has ridden in on the crest of the improvement wave and its success insofar as increased yields are concerned is due to the improvement which took place generally.

In addition to the increased and intelligent use of commercial fertilizers, which appears to be the most important factor, other factors which have played their parts in helping to increase yields and which are of varying degrees of importance, are improved methods of soil management, seed selection particularly in the case of corn and potatoes during the past few years and increased efficiency in controlling injurious insects and plant diseases. It may also be noted that the introduction and extension of the acreage of alfalfa and the more intelligent growing of other legumes have played a part in the improvement of the productive power of the land. Some of the more common legumes, like soybeans, cowpeas, crimson clover, alfalfa and vetch, have been introduced into the state since 1880, although small acreages of some were known before that date.

These increases in yields can be taken as part of the evidence that farming is becoming more efficient and credit is due to all agricultural agencies in the state which have contributed toward this result by advocating and striving to advance new or better methods.